To put this in other words, we can obtain from the heat of formation of cuprous chloride, or of cupric chloride, an approximate calculation of the difference of electric potential between the copper atom and the chlorine atom in the two salts.

Now, as already stated, the heat of formation per chlorine atom is nearly the same; that is, the difference of potential between the copper and chlorine is nearly the same in both salts. What follows from this?

It follows that, in doubling the electric charge on the copper atom, the potential is not also doubled. This means, therefore, that the capacity for electricity of the atom is increased at the same time. This conclusion is not quite certain, as our information is still too scanty on the actual differences of potential in the case of these two salts; and, further, we do not know what fraction of it belongs to the chlorine atom; but, on the whole, the facts we have point to the above conclusion, and it is at any rate a subject well worthy of study to determine whether the capacity of the atom for electricity can vary or not.

Passing from this, I wish to point out another very obvious but nevertheless important deduction to be made from the facts of electrolysis.

We have recognised that the difference between monovalent and divalent copper consists in the doubling of the charge upon the atom. This again may be due to some profound change in the atom itself, but it is at any rate the obvious and marked distinction; we have copper in both cases, but double the electrical charge in one case over that in the other.

If we searched among the elements, could we find two series of salts more completely different in their nature and properties than the cuprous and cupric salts?

I venture to say that, if we did not know we could derive the same element from both, we should assume them to be derived from two different elements, and assign them very different places in Mendelejeff's table. Many other examples of the same thing will occur to everybody, namely, that alteration of the electrical charge on the atom is accompanied by profound alteration in the nature of its compounds, and is therefore probably the cause of this alteration.

Up to this point I think my deductions are fair and obvious deductions from the facts of electrolysis. I wish now to suggest a possibility, I can call it no more, which if true will considerably alter our views of the facts of chemistry. We have found the importance of alterations of electrical charge in altering the properties of an atom as shown in its compounds.

We already believe that variations in atomic weight are closely allied with the variations in the properties of the atom as shown in its compounds.

Are there, then, two things which condition the chemical properties of an atom, or is there only one?

Let us look again for an instant at the facts of electrolysis, and let us take the electrolysis of hydrochloric acid as our example.

At present we state the facts thus:—Every molecule of hydrochloric acid consists of one atom of chlorine and one atom of hydrogen, the chlorine atom weighing 35·5, the hydrogen atom weighing 1. On passing a current, each molecule is split into these two atoms, each atom carrying a unit charge of electricity.

Is it not just possible that we may some day state the facts thus:—A molecule of hydrochloric acid consists of one molecule of hydrogen weighing 1 combined with 35·5 molecules of chlorine each weighing 1. On electrolysis, the chlorine atoms are split from the hydrogen atom, the chlorine atoms each carrying unit charge of electricity, and the hydrogen atom carrying 35·5 charges of electricity.[1]

If this is the truth, then all the atoms of the elements are of the same weight, and probably are made of the same "stuff," and we have two, and only two, things which condition the properties of the atom—namely, its electrical charge and its electric potential, and Mendelejeff's table becomes a statement of the periodic relationship between these.

In suggesting this vague possibility, I do not wish to obscure the first part of the paper, which consists, I believe, of perfectly legitimate deductions from the facts of electrolysis.

I have purposely avoided giving many examples, as I have been dealing with such familiar and common-place chemical reactions that plenty of examples will at once occur to every reader; and sufficient has, I think, been said to show at any rate the importance of experimental inquiry into this subject, and the probability of considerable modifications of our views of chemical facts in the near future.

The new way of looking on valency, which we owe to Prof. Helmholtz, may, as I have already pointed out, completely alter our conception of the nature of an unsaturated carbon compound, and of the process by which saturation takes place; and probably as investigation proceeds in this department it will become necessary to re-dissolve our chemical facts and crystallise them out in completely new mental concepts, while doubtless the ideas associated with the graphic formula pass away and leave not a wrack behind.

A. P. LAURIE

MUSIC AND MATHEMATICS

YESTERDAY afternoon meeting at a friend's house a lady visitor to Oxford who was to sing that evening at one of the hebdomadal concerts in Balliol College, and the conversation happening to turn on the gifted mathematical lady Professor in the University of Stockholm, my thoughts shaped themselves, as I was walking home, into the following lines, which, if likely to interest any of your readers, I shall be happy to see appear in the world-wide-diffused columns of NATURE.

New College, November 15 J. J. SYLVESTER

SONNET

To a Young Lady about to sing at a Sunday Evening Concert in Balliol College

Fair maid! whose voice calls Music from the skies
Weaving amidst pale glimpses of the moon
Tones with fresh hues of glowing fancy strewn
And soft as dew that falls from pitying eyes—
Let from their virgin fount those accents rise
That bid sad Philomel suspend her tune,
Thinking the lark doth chant his lay too soon—
Whose else that trill which with her own note vies!
To her whose star shines bright o'er Maelar lake
And thee who beautifi'st glad Isis' shore
Grant! I one joint harmonious garland bind:
Thou canst with sounds our senses captive take—
She the true Muse, fond poets feigned of yore,
Strike Heaven's own lyre, Nature's o'erruling mind.

NOTES

MR. HAROLD B. DIXON has been appointed Professor of Chemistry and Director of the Chemical Laboratories at Owens College, Manchester.

THE *Oxford Magazine* announces that Prof. Burdon Sanderson and Mr. Gotch are going to spend their Christmas vacation at Arcachon, where there is awaiting them a large tank full of torpedoes. It looks forward with interest to the publication of the results of the Oxford physiologists' holiday, remarking that "to the research will be added the pleasing excitement of danger; for if incautiously handled these torpedoes will give the physiologist a shock, compared with which the agonies of scores of vivisected rabbits are as nothing." Of course this is not true.

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[1] No one need quibble about the 35·5.

Mr. William Fawcett, one of the assistants in the Department of Botany in the British Museum, has been appointed by the Secretary of State for the Colonies to the post of Director of the Public Gardens and Plantations in Jamaica.

The Uralian Society of Natural Sciences is arranging to hold a Scientific and Industrial Exhibition of Siberia and the Ural Mountains in 1887, at Ekaterinburg. The Exhibition promises to be of great scientific interest, including sections of geology, botany, zoology, anthropology, and archæology. The anthropology especially will be of the most comprehensive character. It will include a certain number of families of Bashkirs, Kirghizes, Vogones, Ostiaks, Samoiedes, and other half-civilised peoples of Siberia, with their dwellings, and appliances for hunting and fishing, besides models, figures, costumes, &c. There will also be a large collection of prehistoric objects. The grounds around the Exhibition building will be utilised to give a fairly accurate idea of the arborescent vegetation of the countries represented. Delegates from foreign Societies intending to visit the Exhibition will be accorded special travelling privileges, and be received with the greatest hospitality. The Exhibition will be open from May 27 to September 27. The President of the Society is General Ivanoff, and the President of the Exhibition Committee M. A. Miclowsky.

Mr. Arthur Grote died on the 4th inst. at his residence in Ovington Square. He was born in 1814. He was a Fellow of the Royal Society and also of the Linnean Society. Mr. Grote wrote a number of papers on subjects connected with botany and natural history, and contributed an introduction to Hewitson's "Descriptions of New Indian Lepidopterous Insects in the Atkinson Collection." He was engaged for many years in Her Majesty's Indian Civil Service.

Mr. W. Galloway writes with reference to the recent explosion at Elemore Pit :—"Elemore Pit is one of the Heeltan group of collieries near Newcastle-on-Tyne, which are accounted to be amongst the best and most carefully managed mines in this or any other country. It is under the direct supervision of Mr. Lindsay Wood—a member of the late Royal Commission on Accidents in Mines. The workings are dry and dusty; no accumulation of gas was known to exist anywhere; a shot is supposed to have been fired at the moment the explosion took place, for shot-firing was going on. The explosion appears to have been confined to the in-take air-ways, and to have shot up the downcast shaft, or, in other words, to have traversed a region filled with fresh air without any admixture of fire-damp. These features of this and other similar explosions of late appear to militate somewhat against the views expressed in the Report of the Royal Commission on Accidents in Mines, to the effect that coal-dust alone was a comparatively harmless agent in the absence of fire-damp."

The following are the arrangements for the lectures before Easter at the Royal Institution :—Prof. Dewar, six lectures (adapted to a juvenile auditory) on "The Chemistry of Light and Photography"; Prof. Gamgee, eleven lectures on "The Function of Respiration"; Prof. Rücker, five lectures on "Molecular Forces"; Prof. Max Müller, three lectures on "The Science of Thought"; Mr. Carl Armbruster, five lectures on "Modern Composers of Classical Song"; and Lord Rayleigh, six lectures on "Sound." The following are the probable arrangements for the Friday evening meetings before Easter :—Sir William Thomson, on "The Probable Origin, the Total Amount, and the Possible Duration of the Sun's Heat"; Mr. W. Baldwin Spencer, on "The Pineal Eye in Lizards"; Mr. Edwin Freshfield, on "Some Unpublished Records of the City of London"; Mr. E. B. Poulton, on "Gilded Chrysalides"; Mr. W. Crookes, on "Genesis of Elements"; Capt. Abney, on "Sunlight Colours"; Mr. V. Horsley, on "Brain Surgery in the Stone Ages"; Archdeacon Farrar, on "Society in the Fourth Century A.D."; Mr. G. J. Romanes, on "Mental Differences between Men and Women"; and Lord Rayleigh, on "Colours of Thin Plates."

An Edinburgh Correspondent writes :—"Mr. Romanes has just delivered his first course of lectures on the Philosophy of Natural History to a large and appreciative audience, including students from all the Faculties in the University of Edinburgh."

The Minister of French Postal Telegraphy has sent to Brussels a delegate to arrange for establishing a telephonic line between Paris and that city. The price for the use of the telephone will be five francs for a period of five minutes. It is the first step on record towards an international telephonic system.

A remarkable fire-ball was seen at Stonyhurst College, Blackburn, on December 4, at 9.16 p.m. Although the moon was shining brightly, it lit up the sky like a brilliant rocket. Its course was from 27 Lyncis to θ Gemini, and as it advanced it left a fine streak behind it. Its colour was a bluish-white. At first it moved swiftly, then more slowly, and, before vanishing, burst into several fragments. There was no streak left where the meteor burst, but only in the first part of its course. It was like a horse-tail cirrhus, the bushy portion surrounding the star 27 Lyncis, and thence extending in a narrower streak about 3°. It remained visible for one minute and a half, the part last to fade being that about 27 Lyncis.

We have received the last number (part 2, vol. iv.) of the *Proceedings* of the Liverpool Geological Society. The presidential address by Mr. Mellard Reade, "On the North Atlantic as a Geological Magazine," is a continuation of the line of investigation sketched out by him in his previous address, which was entitled "Denudation of the two Americas." The papers deal mainly with the geology of Liverpool and the neighbourhood, especially North Wales. A paper by the Secretary, Mr. W. Hewitt, "On the Topography of Liverpool," must be specially interesting and instructive to those acquainted with the present geography of that great city.

The active volcano, Asamayama, appears to be attracting particular attention just now in Japan, probably because it is the loftiest mountain in the country which is in a constant state of activity, and also because it is the nearest to the capital, and is situated in a district long famous for its health resorts. A few weeks since we referred to an anonymous account of the crater, published in the *Japan Weekly Mail*, but a much more careful sketch of it is given by the Japan Correspondent of the *Times* in a letter published recently in that journal. The roar of the volcano, on approaching the edge of the crater, he describes as not unlike the noise produced by the passage of a train across a bridge under which one is standing. There was no shaking, however, but loud hissing and bubbling constantly proceeded from numberless vapour-jets in the inner face of the crater-wall, from its rim downwards. The crater is a rough oval in shape, but the estimates of its size are most conflicting. The Japanese give the circumference as four miles, but this is simply a wild guess. A German explorer set down the diameter at 1100 yards, and an English mathematical professor put it at only 200 yards, "divergences that will illustrate the mental confusion to which some men are liable when in the presence of dread natural phenomena." The writer himself estimated the circumference at 1056 yards, by walking round the windward half of it—it was impossible to pass through the vapours on the lee side—which was accomplished in six minutes, at the rate of about three miles an hour.

On the very interesting question of the depth of the crater—that is, the depth from the mouth to the surface of the molten matter—opinions vary almost as hopelessly as on the size. No doubt the "vast clouds of the most pungent sulphurous steam," which are described as rising swiftly out of the caldron, render exact observation difficult. The *Times* Correspondent speaks of catching glimpses of the crater-wall at depths which a very moderate estimate would place at 300 feet. But the gradual convergence of the cavity apparent at this depth forbids the acceptance of the enormous profundity for which some visitors have contended, and suggests that the depth can hardly much exceed 500 feet. After a weird description of the appearance presented to the spectator by the volcano at work, the writer concludes by remarking that the present crater is apparently the youngest and innermost of three. Further down on the south west side are to be seen, along with numerous fissures of unfathomable depth, remains which point to the existence of two former craters, concentric and of large dimensions, and separated from one another by a considerable interval. Possibly the existing cone was formed by the great eruption of 1783.

A TELEGRAM from New York of December 2, states that eight slight shocks of earthquake are reported from Summerville, one severe shock from Columbia, and two slight ones from Charleston. No damage was caused. Dr. Forel writes that earthquakes were felt in Switzerland on November 25 at 3h. at Pontresina and Bernina (Grisons), and again at 3h. 58m. (both Greenwich times) at Pontresina.

ACCORDING to the *Ceylon Observer*, Mr. C. Stevens, a naturalist, has returned to Colombo from a most successful and interesting sojourn amongst the Veddahs, whose district he has thoroughly explored, and with whom he was enabled to establish a closer intimacy than any European ever did before. He has been able to clear up a good many dubious points relating to the manners, customs, and religious beliefs of these veritable wild men of the woods. He has succeeded in obtaining several perfect skeletons, and a number of skulls.

THE *London and China Telegraph* states that a Folk-Lore Society has been established in the Philippines, at the prompting of a Society for the study of folk-lore in Spain. The archipelago certainly presents a wide field for investigation and inquiry in this respect, on account of the diversity of native races inhabiting it. The survivals in the shape of traditions, customs, and observances amongst the primitive tribes still to be found in the inaccessible interior of many of the islands may be expected to throw much light on the early history of the people, and on the origin of many superstitious practices common in more civilised lands.

THE Report of the Public Free Libraries of the City of Manchester, while expressing the deep regret of the Committee at the loss of Sir Thomas Baker, their chairman for nearly twenty-five years, is at the same time a testimonial to the ability and judgment with which the work under his care has been carried on. Additional libraries, a tenfold increase in circulation since the two first of them were opened, and over 4000 volumes withdrawn this year as *worn out*, are proofs of the earnestness of this work. Nor does the increase seem likely to cease, for the extension of the time of keeping open the reading-rooms till 10 o'clock, although it adds to the already long hours of those engaged in their management, is sure, we think, to increase their counter-attraction to the public-houses, and to bring up the number of visitors annually to the libraries to three millions. Two recently incorporated districts also have requested that equal advantages may be extended to them, and help in carrying this out has been liberally supplied by independent public bodies. A remarkably large proportion of books are taken out to be read in the reading-rooms. Boys especially avail themselves of these rooms on a Sunday, nearly twice as many of them attending then as on a week-day; a direct reversal of the practice of other classes. The success of Manchester is the more marked that so moderate a proportion of fiction is supplied to its readers.

THE additions to the Zoological Society's Gardens during the past week include two Macaque Monkeys (*Macacus cynomolgus* ♂ ♀) from India, presented by the Countess Dowager of Lonsdale; a Mona Monkey (*Cercopithecus mona* ♀) from West Africa, presented by Miss Bashall; a Domestic Sheep (*Ovis aries*, var.) from West Africa, presented by Sir Albert Kaye Rollitt, F.Z.S.; a Grey-striped Mouse (*Smithus vagus*) from the Tatra Mountain, presented by Dr. A. Wryesniowski; a Poë Honey-eater (*Prosthemadera novæ-zealandiæ*) from New Zealand, presented by Capt. B. J. Barlow, s.s. *Taimu;* a Blue-fronted Amazon (*Chrysotis æstiva*) from Brazil, presented by Miss Joachim; two Tuatera Lizards (*Sphenodon punctatus*) from New Zealand, presented by Dr. E. B. Parfitt; a Cerastes Viper (*Vipera cerastes*) from Egypt, presented by Mr. J. H. Leech, F.Z.S.; a Beisa Antelope (*Oryx beisa* ♂) from North-East Africa, a Rough Fox (*Canis rudis*) from Guiana, purchased; a Red Kangaroo (*Macropus rufus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

CORRECTIONS TO REFRACTION TABLES.—Prof. Cleveland Abbe, in a short note to the *Astronomische Nachrichten*, calls attention to the fact that the reading of the mercurial barometer which is used in the refraction-formula as an index to the density of the air is not a true index to the pressure controlling that density until it is corrected for the effect of the variations in gravity. The correction is accomplished by adding one more factor, g, for gravity, when the formula becomes—

$$R = \alpha \tan z \left(\frac{1 - 0{\cdot}00259 \cos 2\phi}{1 - 0{\cdot}00259 \cos 2\phi_0} \, BT \right)^{A} \gamma^{\lambda},$$

where ϕ is the latitude of the observer, and ϕ_0 of the station for which the tables were computed. Prof. Cleveland Abbe considers that the omission of this correction for gravity may partly explain the origin of small systematic differences in the declinations of different star-catalogues, though such differences, so far as they are due to refraction, must also be caused by local irregularities in the distribution of pressure and temperature, which produce effects equivalent to slight inclinations of the horizontal planes of equal density. The systematic changes in his distribution, due to change of season, must introduce an annual variation in refraction similar to the effect of parallax, and it will occasion a difference in the refractions north and south of the zenith, which may often attain an appreciable amount.

COMET FINLAY (1886 *e*).—The following ephemeris by Dr Krueger, for Berlin midnight, is in continuation of that given in NATURE of November 25 (p. 85):—

1886	R.A.			Decl.		log r	log Δ	Brightness
	h.	m.	s.	°	′			
Dec. 10	22	2	49	13	25·6 S.	0·0074	9·8941	3·1
14	22	23	51	11	9·7	0·0142	9·8909	3·0
18	22	44	58	8	46·0	0·0221	9·8901	2·9
22	23	6	0	6	16·7	0·0309	9·8917	2·8
26	23	26	49	3	44·6 S.	0·0404	9·8958	2·6

The brightness at date of discovery is taken as unity.

COMET BARNARD (1886 *f*).—This object is now visible to the naked eye, and is at its brightest. As it is now visible in the early evening, it should be frequently observed. The following ephemeris by Dr. Aug. Svedstrup, for Berlin midnight (*Astr. Nachr.*, No. 2756), is in continuation of that given in NATURE of November 25 (p. 85):—

1886	R.A.			Decl.		log r	log Δ	Brightness
	h.	m.	s.	°	′			
Dec. 11	17	6	7	16	20·9 N.	9·8266	0·0004	24·7
16	17	54	19	13	43·9	9·8212	0·0300	22·1
21	18	34	18	10	32·2	9·8266	0·0679	18·0
26	19	6	32	7	13·7	9·8421	0·1084	14·0
31	19	32	32	4	5·2 N.	9·8652	0·1478	10·5

The brightness at date of discovery is taken as unity.